WHAT IS CLAIMED IS:

1. A method for efficient operation of a two-dimensional MEMS grating, said method comprising:

   selecting a wavelength (λ)of near monochromatic spatially coherent light;

   determining a grating pitch, an angle of incidence, a tilt angle, and a diffraction order to satisfy:

$$\theta_t(\theta_i, n) = 1/2 \ \{\arcsin [(n \lambda / d)\sqrt{2} - \sin(\theta_i)] + \theta_i \}$$

   where:

   θ_t is a tilt angle relative to said MEMS grating normal,

   θ_i is an angle of incidence relative to said MEMS grating normal,

   n is a diffraction order,

   λ is a wavelength of incident near monochromatic spatially coherent light, and

   d is a pixel grating pitch of said MEMS grating.

2. The method of Claim 1, wherein a center of a Fraunhofer envelope is aligned with said n^{th} diffraction order.

3. The method of Claim 1, said determining a grating pitch, an angle of incident, a tilt angle, and a diffraction order comprising determining a grating pitch and a tilt angle for a micromirror device.

4. The method of Claim 1, comprising:

   illuminating said MEMS grating with near monotonic spatially coherent light at said angle of incidence; and

collecting said near monotonic spatially coherent light from said n^{th} diffraction order.

5. The method of Claim 4, said illuminating performed such that said illumination light and said collected light traverse a common path.

6. The method of Claim 4, said determining a grating pitch, an angle of incident, a tilt angle, and a diffraction order comprising determining a grating pitch and a tilt angle for a micromirror device, said illuminating performed such that said illumination light and said collected light traverse a common path, said common path normal to a tilted micromirror of said micromirror device.

7. A micromirror device comprising:

a two-dimensional array of deflectable mirrors, said array having a pitch distance (d) between adjacent mirrors;

a deflectable member supporting each said mirror, said deflectable member establishing a tilt angle for each its corresponding mirror; and

wherein said micromirror device is blazed for near monochromatic spatially coherent light having a wavelength in the range of 1480-1580 nm.

8. The micromirror device of Claim 7, wherein said micromirror device is blazed in the Littrow condition for near monochromatic spatially coherent light having a wavelength in the range of 1480-1580 nm.

9. A system for fiber optic/telecommunication switching/modulating applications, comprising:

an optical grating;

one or more near monochromatic spatially coherent light input signals coupled to said optical grating, said optical grating converting said light into collimated channels of varying frequency, said collimated light being passed through condensing optics on to the surface of a micromirror device;

said micromirror device comprising:

a two-dimensional array of deflectable mirrors, said array having a pitch distance (d) between adjacent mirrors; and

a deflectable member supporting each said mirror, said deflectable member establishing a tilt angle for its corresponding mirror; and

wherein said micromirror device is blazed for near monochromatic spatially coherent light having a wavelength in the range of 1480-1580 nm.

10. The system of Claim 9, said system operable to selectively add or remove frequency channels from said light.

11. The system of Claim 9, said system operable to selectively modulate frequency channels from said light.

12. The system of Claim 9, said system operable to selectively switch frequency channels from said light.

13. The system of Claim 9, said system operable to selectively attenuate frequency channels from said light.

14. A method for achieving a blazed condition in a two-dimensional MEMS grating device, comprising the alignment of the Fraunhofer envelope center, determined

by the pixel pitch and tilt angle of said MEMS device, with an optical diffraction order, further comprising the steps of:

for a given near monochromatic spatially coherent light at a given incident angle, θ_i, determining the angle for the n^{th} diffraction order of said light as

$\sin(\theta_n) = \sin(-\theta_i) + n\lambda / d$, where

θ_n is the angle of the n^{th} diffraction order,

n is the diffraction order,

λ is the wavelength of said incident light, and

d is the pixel grating pitch of said MEMS device;

satisfying the blaze condition that

$\sin(\theta_n) = \sin(\theta_F)$, where θ_F is the angle for the Fraunhofer envelope, to align the center of the Fraunhofer envelope center with diffraction order n, and further

$\theta_F = -\theta_i + 2\theta_t$, where θ_t is the tilt angle of the individual grating mirrors; and

satisfying the condition

$$\theta_t(\theta_i, n) = 1/2 \{\arcsin[(n\lambda / d)\sqrt{2} - \sin(\theta_i)] + \theta_i\}.$$

15. The method of Claim 14, wherein said MEMS device is a digital micromirror device.

16. The method of Claim 14, wherein:

said incident light and 0^{th} order reflected light are measured as:

θ_i and θ_r relative to said DMD's array normal,

ϕ_i and ϕ_r relative to said DMD's tilted mirror normal;

said diffraction orders are separated by equal distances along the x-axis, as given by $x = \sin(\Psi(n))$, where Ψ is the diffraction order angle; and

the distance between the 0^{th} diffraction order and the Fraunhofer envelope is a constant angle, that being equal to two times the tilt angle, θ_t.

17. The method of Claim 16, wherein the incident light, ϕ_i, and reflected light, ϕ_r, transverse the same path, further meeting the special conditions for Littrow blaze, which are

$\phi_i = \phi_r = 0$,

$\theta_i = \theta_t$, and

ϕ_i is that of a diffraction order, so that

$\theta_t(n) = \arcsin(\lambda / d \cdot n / \sqrt{2})$.

18. The method of Claim 17, wherein operation in the Littrow condition utilizes the same optics for said incident and said reflected light.

19. The method of Claim 18, wherein said Fraunhofer envelope determines the amount of energy aligned with an n^{th} diffraction order, wherein:

said power is conserved; so that

for mirror tilt angle, θ_t, and pixel pitch, d, that aligns said Fraunhofer envelope center with a diffraction order, a blazed condition exists, providing available energy as a concentrated spot of light;

for flat mirrors the Fraunhofer envelope center aligns with the 0^{th} diffraction order, thereby yielding a blazed condition for said 0^{th} diffraction order; and

for mirror tilt angle and pixel pitch that aligns said Fraunhofer envelope center between diffraction orders, said energy is spread over multiple diffraction orders, lowering the intensity of said spot of light and thereby raising the background level of the signal.

20. The method of Claim 19, wherein the Fraunhofer envelope for the light reflected off the pixel surfaces is given as the Fourier transform, $\Im$, of the aperture function, G, for a pixel (mirror) of the DMD, the available orders being determined by the Fourier transform of the array of delta functions representing the array, written as

$\Im(F * G)$, which is equivalent to the product $\Im(F) \bullet \Im(G)$, giving

$$\Im(F * G) = \Im(F) \bullet \Im(G).$$

21. A switchable two-dimensional blazed grating device, wherein the center of the Fraunhofer envelope is aligned with a optical diffraction order, comprising:

a matrix of reflective pixels, said individual pixels being capable of tilting in a positive and negative direction about a diagonal axis;

said pixel's pitch and tilt angle made to satisfy the conditions:

$\sin(\theta_n) = \sin(-\theta_i) + n\lambda / d$, where

θ_n is the angle of the n^{th} diffraction order,

n is the diffraction order,

λ is the wavelength of said incident light, and

d is the pixel grating pitch of said MEMS device;

$\sin(\theta_n) = \sin(\theta_F)$, where

θ_F is the angle for the Fraunhofer envelope to be aligned with one of the n diffraction orders;

$\theta_F = -\theta_i + 2\theta_t$, where

θ_t is the tilt angle of an individual pixel; and

$\theta_t(\theta_i, n) = 1/2\ \{\arcsin [\ (n\ \lambda\ /\ d)\sqrt{2}\ - \sin (\theta_i)\ ] + \theta_i\}$

22. The device of Claim 21, wherein said MEMS device is a digital micromirror device.

23. The device of Claim 21, wherein said Fraunhofer envelope determines the amount of energy aligned with an n^{th} diffraction order, wherein:

said power is conserved; so that

for mirror tilt angle, θ_t, and pixel pitch, d, that aligns said Fraunhofer envelope center with a diffraction order, a blazed condition exist;

for flat mirrors the Fraunhofer envelope center aligns with the 0^{th} diffraction order, thereby yielding a blazed condition for said 0^{th} diffraction order; and

for mirror tilt angle and pixel pitch that aligns said Fraunhofer envelope center between diffraction orders, said energy is spread over multiple diffraction orders, lowering the intensity of said spot of light and thereby raising the background level of the signal.

24. The device of Claim 23, wherein the Fraunhofer envelope for the light reflected off the pixel surfaces is given as the Fourier transform, $\Im$, of the aperture function, G, for a pixel (mirror) of the DMD, the available orders being

determined by the Fourier transform of the array of delta functions representing the array, written as

$\Im$ (F * G) , which is equivalent to the product $\Im(F) \bullet \Im(G)$, giving

$$\Im(F * G) = \Im(F) \bullet \Im(G).$$

25. The device of Claim 24, wherein:

said incident light and 0^{th} order reflected light are measured as:

θ_i and θ_r relative to said DMD's array normal,

ϕ_i and ϕ_r relative to said DMD's tilted mirror normal;

said diffraction orders are separated by equal distances along the x-axis, as given by $x = \sin(x(n))$, where x is the diffraction order angle; and

the distance between the 0^{th} diffraction order and the Fraunhofer envelope is a constant angle, that being equal to two times the tilt angle, θ_t.

26. The device of Claim 25, wherein the incident light, ϕ_i, and reflected light, ϕ_r, transverse the same path, further meeting the special conditions for Littrow blaze, which are

$\phi_i = \phi_r = 0$,

$\theta_i = \theta_t$, and

ϕ_i is that of a diffraction order, so that

$$\theta_t(n) = \arcsin(\lambda / d \cdot n / \sqrt{2}).$$

27. A system for fiber optic/telecommunication switching/modulating applications, comprising:

one or more near monochromatic spatially coherent light input signals coupled to an optical grating;

said optical grating converting said light into collimated channels of varying frequency, said collimated light being passed through condensing optics on to the surface of a DMD;

said DMD being fabricated with pixel pitch and tilt angle optimized to meet blazed operational conditions when used with near monochromatic spatially coherent light having a given wavelength and incident angle;

said DMD being capable of switching, modulating, adding frequency channels to, and removing frequency channels from, said light.

28. The system of Claim 27, wherein said DMD optimization is accomplished by:

aligning the Fraunhofer envelope center, determined by the pixel pitch and tilt angle of said DMD, with a diffraction order, comprising the steps of:

for a given near monochromatic spatially coherent light at a given incident angle, θ_i, determining the angle for the n^{th} diffraction order of said light as

$\sin(\theta_n) = \sin(-\theta_i) + n\lambda / d$, where

θ_n is the angle of the n^{th} diffraction order,

n is the diffraction order,

λ is the wavelength of said incident light, and

d is the pixel grating pitch of said MEMS device;

satisfying the blaze condition that

$\sin(\theta_n) = \sin(\theta_F)$, where θ_F is the angle for the Fraunhofer envelope, to align the center of the Fraunhofer envelope center with diffraction order n, and further

$\theta_F = -\theta_i + 2\theta_t$, where θ_t is the tilt angle of the individual grating mirrors; and

further satisfying the condition

$$\theta_t(\theta_i, n) = 1/2 \{\arcsin [(n \lambda / d)\sqrt{2} - \sin(\theta_i)] + \theta_i \}$$

29. The method of Claim 28, wherein:

said incident light and 0^{th} order reflected light are measured as:

θ_i and θ_r relative to said DMD's array normal,

ϕ_i and ϕ_r relative to said DMD's tilted mirror normal;

said diffraction orders are separated by equal distances along the x-axis, as given by $x = \sin(x(n))$, where x is the diffraction order angle; and

the distance between the 0^{th} diffraction order and the Fraunhofer envelope is a constant angle, that being equal to two times the tilt angle, θ_t.

30. The system of Claim 29, wherein the incident light, ϕ_i, and reflected light, ϕ_r, transverse the same path, further meeting the special conditions for Littrow blaze, which are

$\phi_i = \phi_r = 0$,

$\theta_i = \theta_t$, and

ϕ_i is that of a diffraction order, so that

$$\theta_t(n) = \arcsin(\lambda / d \cdot n / \sqrt{2}).$$

31. The system of Claim 30, wherein operation in the Littrow condition utilizes the same optics for said incident and reflective light.

32. The system of Claim 31, wherein said Fraunhofer envelope determines the power aligned with an n^{th} diffraction order, wherein:

said power is conserved; so that

for mirror tilt angle, θ_t, and pixel pitch, d, that aligns said Fraunhofer envelope center with a diffraction order, a blazed condition exist;

for flat mirrors the Fraunhofer envelope center aligns with the 0^{th} diffraction order, thereby yielding a blazed condition for said 0^{th} diffraction order; and

for mirror tilt angle and pixel pitch that aligns said Fraunhofer envelope center between diffraction orders, said energy is spread over multiple diffraction orders, lowering the intensity of said spot of light and thereby raising the background level of the signal.

33. The system of Claim 32, wherein the Fraunhofer envelope for the light reflected off the pixel surfaces is given as the Fourier transform, $\Im$, of the aperture function, G, for a pixel (mirror) of the DMD, the available orders being determined by the Fourier transform of the array of delta functions representing the array, written as

$\Im$ (F * G) , which is equivalent to the product $\Im(F) \bullet \Im(G)$, giving

$\Im (F * G) = \Im(F) \bullet \Im(G)$.

34. The system of Claim 33, wherein said system is used as a wave division multiplexer, wherein:

wavelength channels are reconfigured; and

any subset of wavelengths can be added or dropped.

35. The system of Claim 33, wherein said system is used as a wave division, variable optical attenuator, wherein:

said DMD mirrors are modulated to attenuate the signal by channel; and

the fast switching time of said system minimizes noise.

36. The system of Claim 33, wherein said system is used as a tunable 1520-1580 nm laser, wherein:

each channel wavelength is produced using a single laser module;

said DMD tuned laser is tunable in gigahertz steps; and

said DMD tuned laser is 10,000 times faster than comparable mechanical lasers.